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Understanding Differences in the Choice of College Attended: The Role of State Public Policies

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Abstract

Two recent reports by the Institute for Higher Education Policy describe the increasing “economic stratification” of the nation’s higher education system. In *The Tuition Puzzle: Putting the Pieces Together*, the Institute (1999) concluded, based on its review of prior research, that decreasing shares of students from middle- and upper-income families are enrolling in public two-year institutions, while increasing shares of students from upper-income families are enrolling in public and private universities. In *The Policy of Choice: Expanding Student Options in Higher Education*, the Institute (2002) concluded that choice is “declining” for some groups of students, particularly dependent undergraduates with the lowest family incomes.

The findings in *Unequal Opportunity*, a report released by the Lumina Foundation for Education (Kipp, Price, & Wohlford, 2002), suggest that state public policies are one source of economic stratification and that the extent to which college choice is restricted for low-income students varies across the 50 states in part because of variations in state public policies. For example, the report shows that all public four-year colleges are “affordable” for low-income, dependent students, even with borrowing, in only five of the 50 states (Alaska, Arkansas, Hawaii, Kentucky, and Wyoming).

This study addresses the observation by the Institute for Higher Education Policy (1999) that data is needed on the causes of higher education’s economic stratification. Using multilevel modeling, we empirically test the suggestion that state public policies influence the type of college or university that high school graduates attend, after taking into account student level predictors of enrollment.

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SPECIAL FOCUS ON STUDENTS: RACE, CLASS, AND CHOICE

Understanding Differences in the Choice of College Attended: The Role of State Public Policies

Laura W. Perna and Marvin A. Titus

Two recent reports by the Institute for Higher Education Policy describe the increasing “economic stratification” of the nation’s higher education system. In *The Tuition Puzzle: Putting the Pieces Together*, the Institute (1999) concluded, based on its review of prior research, that decreasing shares of students from middle- and upper-income families are enrolling in public two-year institutions, while increasing shares of students from upper-in-

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come families are enrolling in public and private universities. In *The Policy of Choice: Expanding Student Options in Higher Education*, the Institute (2002) concluded that choice is "declining" for some groups of students, particularly dependent undergraduates with the lowest family incomes.

The findings in *Unequal Opportunity*, a report released by the Lumina Foundation for Education (Kipp, Price, & Wohlford, 2002), suggest that state public policies are one source of economic stratification and that the extent to which college choice is restricted for low-income students varies across the 50 states in part because of variations in state public policies. For example, the report shows that all public four-year colleges are "affordable" for low-income, dependent students, even with borrowing, in only five of the 50 states (Alaska, Arkansas, Hawaii, Kentucky, and Wyoming).

This study addresses the observation by the Institute for Higher Education Policy (1999) that data is needed on the causes of higher education's economic stratification. Using multilevel modeling, we empirically test the suggestion that state public policies influence the type of college or university that high school graduates attend, after taking into account student-level predictors of enrollment.

TYPES OF STATE POLICIES THAT MAY INFLUENCE COLLEGE CHOICE

A review of prior research suggests that four kinds of state public policies may influence the type of college that individuals in the state attend: (a) direct appropriations to higher education institutions, (b) financial aid to students, (c) tuition, and (d) policies related to academic preparation at the elementary and secondary school levels.

While tuition and fees represent the largest source of current-fund revenues at private degree-granting institutions, state governments are the largest source at public degree-granting institutions (NCES, 2002). The 50 state governments were the source of more than \$46.3 billion of the total \$130 billion current-fund revenues (36%) of public degree-granting institutions and \$1.5 billion of the total \$74.5 billion current-fund revenues (2%) of private degree-granting institutions in 1996–1997 (NCES, 2002). State appropriations for private higher education vary across states, with greater attention to the private sector in northeastern, southern, and midwestern states than in the plains and western states (Zumeta, 1992).

State public policies regarding student financial aid may also influence the type of college that students attend. While the availability of federal student financial aid is constant across states, the characteristics, including eligibility criteria and average awards, of state-financed student financial aid vary (Zumeta, 1992). The National Center for Public Policy and Higher Education (2002) notes that two states (Alaska and South Dakota) do not sponsor a financial aid program for students, while five states (California,

Illinois, Minnesota, New York, and Pennsylvania) have “substantial” programs.

A growing number of states are devoting resources to merit-based financial aid programs (Heller, 2002). While need-based programs award financial aid to the most economically disadvantaged students, merit-based programs award financial aid to students who meet a specified threshold of academic achievement, a criterion that is positively correlated with family income. Following the lead of Georgia's HOPE Scholarship Program and Florida's Bright Futures Scholarship Program, the two largest state-administered merit-based student aid programs, other states (e.g., Alabama, Kentucky, Louisiana, Maryland, Michigan, New Mexico, Texas, and Washington) have recently implemented such programs (Heller, 2002). Since the mid-1990s, state funding for merit-based financial aid programs has increased at a faster rate than state funding for need-based programs (Heller, 2002).

While technically not set by a state entity in all states, tuition at public higher education institutions is typically determined in part by state policies regarding appropriations and financial aid. Policymakers and researchers disagree about the most appropriate balance between direct appropriations to institutions to reduce the sticker price and support to students through financial aid to reduce the net price. Although much of the debate centers around the effects of high tuition/high aid relative to the effects of low tuition on access to higher education (i.e., whether an individual enrolls in any institution), these two approaches may also have differential effects on the type of institution that a student attends. A high tuition/high aid policy may divert some portion of the most academically qualified enrollments from the public to the private sector (Johnstone, 1999). Asserting that high tuition may be a barrier to enrollment for low-income students if they do not understand that financial aid is available to offset the high sticker price (Johnstone, 1999), proponents of low tuition may also argue that a high tuition/high aid policy may encourage low-income students to enroll in lower price (e.g., public two-year institutions) rather than higher price (e.g., private four-year institutions) sectors of higher education.

While merit-based financial aid programs may be an attempt to improve students' motivation to become academically prepared for college, other state policies that are related to the academic preparation of elementary and high school students may also influence the demand by students for enrollment at different types of institutions. Based on her review and synthesis of prior research, Laura Perna (in press) concluded that academic preparation is one of the most important predictors of both predisposition toward, or interest in, attending college, and actual college enrollment. Although being academically prepared appears to be particularly important to the college enrollment of low-income students (Cabrera, La Nasa, &

Burkam, 2001), lower-income youth are less likely to be academically prepared for college (Perna, in press).

An examination of data presented in *Measuring Up 2000* (National Center for Public Policy and Higher Education, 2000) suggests that the extent to which students are academically prepared for college varies across the 50 states. For example, only 8% of eighth-graders in Arkansas are enrolled in algebra courses compared with 54% in Utah. Only 27% of high school students in Alabama take upper-level math courses, compared with 61% of high school students in Nebraska (National Center for Public Policy and Higher Education, 2000).

RESEARCH ON THE RELATIONSHIP BETWEEN STATE PUBLIC POLICIES AND TYPE OF COLLEGE ATTENDED

Regardless of whether the state and/or the student is the level of analysis, research consistently shows that college enrollment is related to tuition and financial aid. State-level analyses show that an increase in tuition at public four-year institutions is associated with an increase in enrollment at public two-year institutions but a decrease in enrollment at public four-year institutions (Kane, 1995). Using student-level data from the NELS:88/94, Thomas Kane (1999) found that, after controlling for other variables, a \$1,000 increase in tuition at public two-year institutions in the state was associated with a 4.5% decline in college enrollment. Multilevel analyses also show that the likelihood of enrolling in college is negatively related to tuition at public two-year colleges in the state and positively related to state need-based financial aid (Perna & Titus, 2002). Increases in tuition and decreases in state financial aid have a greater effect on enrollment at community colleges than at public four-year institutions (Heller, 1999; Kane, 1999). Low-income students are more sensitive than other students to changes in tuition (Kane, 1995, 1999).

Although state-level, student-level, and multilevel analyses explore the role of state economic and demographic characteristics, the findings are inconsistent. Some (Heller, 1999; Kane, 1999), but not all (Berger & Kostal, 2002), state-level analyses show that enrollment rates at public institutions, especially public two-year institutions, increase when the state unemployment rate rises. One student-level study (Beattle, 2002) found that the odds of enrolling in a two-year or four-year institution increased with state per capita income and was unrelated to the state unemployment rate net of other variables (Beattle, 2002), while another student-level study (Perna, 2000) found that, holding other variables constant, the odds of enrolling in a four-year institution declined as the state unemployment rate rose. A multilevel analysis suggests that, net of other state-level and student-level variables, neither the state unemployment rate nor the child poverty rate is related to the likelihood of enrolling in college (Perna & Titus, 2002).

In addition to inconsistent findings regarding the effects on enrollment of the state economic and demographic context, prior research is limited in at least three other respects. First, with few exceptions (e.g., Perna & Titus, 2002), researchers have examined the relationship between state public policies and college enrollment using either the state or the student as the level of analysis. Multilevel modeling is required to determine the effects of such state-level public policies as tuition and aid on such student-level outcomes as the type of institution attended after taking into account other student-level predictors.

Second, although Larry Leslie and Paul Brinkman (1988) concluded from their review of research that was conducted in the 1970s and 1980s that state student aid programs generally enable low-income students to attend higher-cost institutions and private rather than public institutions, recent examinations of the influence of state public policies on the type of college attended generally distinguish only between attending a public two-year or four-year institution. As a result, little is known about the ways in which current state public policies influence the decision of students to attend a public rather than a private four-year institution or an in-state rather than an out-of-state institution, dimensions that are also likely to be of interest to state policymakers.

Finally, although some researchers included selected measures of state public policies (e.g., tuition, need-based financial aid) and economic and demographic characteristics (e.g., state unemployment rate) in their analyses, few researchers have explored the extent to which state public policies toward K-12 education influence the enrollment of students at different types of higher education institutions.

THEORETICAL FRAMEWORK

Following a recommendation (Perna & Titus, 2002), this research uses an economic approach to college enrollment that has been expanded to include measures of state public policies and other state characteristics. Economic theoretical approaches posit that an individual makes a decision about attending college by comparing the benefits with the costs for all possible alternatives and then selecting the alternative with the greatest net benefit, given the individual's personal tastes and preferences (Hossler, Braxton, & Coopersmith, 1989; Paulsen, 2001). A traditional economic perspective predicts that the decision to invest in higher education is influenced by expected costs and benefits, financial resources, academic ability, perceived labor market opportunities, personal preferences and tastes, and uncertainty (Becker, 1962).

Because the informational and computational requirements that are implied by economic models exceed an individual's information process-

ing capacities, rational models of decision-making are generally regarded as normative rather than descriptive models (Hogarth, 1987). To manage cognitive decision-making demands, individuals adopt such strategies as satisficing or bounded rationality. Patricia McDonough (1997) used Pierre Bourdieu's concept of *habitus* to explain that an individual's expectations, attitudes, and aspirations are not based on rational analyses but are "sensible or reasonable choices" (p. 9). *Habitus*, or the internalized system of thoughts, beliefs, and perceptions acquired from the immediate environment, conditions an individual's expectations, attitudes, and aspirations (Bourdieu & Passeron, 1977; McDonough, 1997; Paulsen, 2001; Paulsen & St. John, 2002; Perna, 2000; St. John & Paulsen, 2001).

Some researchers (e.g., Perna, 2000; Perna & Titus, 2002) expanded traditional economic approaches to college enrollment to include measures of social and cultural capital as proxies for differences in expectations, preferences, and tastes for investing in higher education. Edward St. John and Michael Paulsen (2001) argued that measures of social and cultural capital should be integrated into traditional economic approaches to account for the influence of non-monetary factors on college enrollment. Like human and physical capital, social and cultural capital are resources that may be invested to enhance productivity (Coleman 1988) and facilitate upward mobility (DiMaggio & Mohr, 1985; Lamont & Lareau, 1988). Whereas cultural capital refers to the system of factors derived from one's parents that define an individual's class status (Bourdieu & Passeron, 1977), social capital refers to social networks and the ways in which social connections are sustained (Morrow, 1999). Social capital may also be understood as a tool for describing how individuals gain access to other forms of capital, including human capital and cultural capital, as well as institutional resources and support (Coleman, 1998; Portes, 1998; Morrow, 1999). Research (Perna, 2000) suggests that parental involvement, a measure of social capital, is an important predictor of college enrollment.

An individual's *habitus* regarding college enrollment may also be shaped by state public policies and other state characteristics. For example, a policy of low tuition may not only affect an individual's calculation of the net cost of enrolling in higher education, but also indicate that taxpayers value equity in educational opportunity more than efficiency of expenditures. The preference or taste for higher education may be greater in states in which a relatively high share of adults are college educated than in states in which a relatively small share of adults have completed college. More information about college may be available to students who live in states with a higher number of colleges and universities per capita. Research shows that parents and students overestimate college costs and lack accurate information about financial aid (Ikenberry & Hartle, 1998; Institute, 1999), and that, after controlling for other variables, students are less likely to enroll in college when

their parents lack accurate information and knowledge about financial aid (Higgins, 1984; Flint, 1993).

RESEARCH METHOD

This study uses multilevel modeling to address the following research questions:

1. What is the relationship between state public policies and the type of institution that high school graduates attend after controlling for student-level predictors of college choice and other state characteristics?
2. How do the college enrollment patterns of high school graduates vary by socioeconomic status after taking into account measures of state public policies and other state characteristics?

DATA

We drew student-level data from the National Educational Longitudinal Study (NELS:92/94), a database sponsored by the U.S. Department of Education's National Center for Education Statistics. The analytic sample is limited to students who earned a high school diploma or GED in May or June of 1992. Students attending high schools in the District of Columbia (DC) ($n = 6$) are excluded because of differences in the meaning of some state characteristics between DC and the 50 states and the absence of public two-year institutions in DC. We also excluded students who were missing data for state residence (less than 1%) and students who are American Indian/Alaskan Native (1%). High school graduates who attended for-profit institutions are excluded because of the small sample size; only 313 high school graduates attended a for-profit institution. The analytic sample numbers 10,148 high school graduates in 50 states.

We obtained data for state-level indicators from the Integrated Postsecondary Education Data System, *Digest of Education Statistics* (NCES, 1993, 1994), *State Comparisons of Education Statistics: 1969–70 to 1996–97* (NCES, 1998), National Association of State Scholarships & Grant Programs (NASSGAP), and the Current Population Survey, adding them to the NELS:92/94 database.

STUDENT-LEVEL VARIABLES

The dependent variable, type of institution attended, is measured in October 1992, the fall after high school graduation. The variable has five categories: not enrolled (reference category); enrolled at an in-state public two-year college; enrolled at an in-state public four-year institution; enrolled at an in-state private four-year institution; and enrolled at an out-of-state institution.

Consistent with the theoretical framework described above, this study assumes that enrollment status is determined by student-level and state-level variables that reflect the weighting and ranking of the benefits and costs of enrolling in different types of higher education institutions. In addition to sex and race/ethnicity, the student-level variables measure financial resources, human capital, and social capital. The analyses consider four racial/ethnic groups: African American, Hispanic, Asian, and White (reference group).

Although some (Paulsen & St. John, 2002; St. John & Paulsen, 2001) argue that the components of socioeconomic status (SES) should be separately examined, this study measures financial resources using an SES composite. SES is a continuous NELS-derived composite that is based on mother's and father's educational attainment, mother's and father's occupation, family income, and the number of selected items in the home (e.g., daily newspaper, computer, atlas, more than 50 books). Although perhaps less commonly emphasized in public policy than family income, SES is a better measure than family income from statistical and theoretical perspectives. Clifford Adelman (2002) argues that SES is less influenced by inconsistencies among its components, a substantially smaller share of data are missing for SES than family income, and, to be meaningful, family income should be adjusted to consider family size and be relative to some clear standard of "low income," such as the federally defined poverty level for families of the same size. Moreover, as a measure of social class, SES may reflect an individual's habitus, or preferences and tastes for college enrollment. In this study, we conducted the analyses twice, once with a continuous measure of SES and again with a categorical measure of SES to isolate the enrollment patterns of high school graduates in the lowest quartile of SES.

An individual's initial stock of human capital is measured by the individual's academic achievement and quality of academic preparation. Academic achievement is measured by the standardized composite score on the reading and mathematics tests that NCES administered as part of the NELS data collection in 1992. Prior research consistently shows that individuals with higher test scores are more likely to invest in higher education (Beattie, 2002; Hossler, Braxton, & Coopersmith, 1989; Perna, 2000; St. John, 1991).

Although positively related to college enrollment, participation in an academic curricular track appears to be an unreliable measure of academic preparation (Adelman, 1999; Perna, *in press*; Stevenson, Schiller, & Schneider, 1994). Adelman (1999) suggests that a better measure of the quality and intensity of the high school curriculum is the highest level of coursework that is completed in particular subjects. Because the hierarchical sequence of courses is clearer for mathematics than for other subjects, this research, like other research (e.g., Horn, 1997; Perna & Titus, 2002), measures the

quality of academic preparation by the highest level of mathematics coursework that was completed. A series of dichotomous variables reflects a student's highest level of mathematics: algebra I and geometry; algebra II; or at least one advanced math course. Other or no mathematics coursework is the reference category.

Parent-student discussions about educational issues, a measure of social capital (McNeal, 1999), may promote college enrollment by enhancing a student's human capital. Following the example of others (e.g., Horn 1997; Perna, 2000; Perna & Titus, 2002), factor analysis is used to construct the measure of parental involvement using six variables in the NELS database. The six survey items reflect the frequency of discussions between students and their parents about high school course selections, school activities, topics studied, grades, plans to take the SAT or ACT, and applying to college. The alpha reliability coefficient for this factor is 0.83.

To minimize the effects of listwise deletion of missing data on the size of the analytic sample, the student-level model includes a single independent variable that reflects the "tendency to have missing data" (Cohen & Cohen, 1983). This variable is calculated as the number of independent variables in the student-level model on which data are missing. For the continuous variables that are missing data (e.g., parental involvement), the mean value for all missing cases is imputed (Cohen & Cohen, 1983).

STATE-LEVEL VARIABLES

The analyses include measures of four types of state public policies: direct appropriations to institutions, tuition, financial aid to students, and academic preparation during elementary and secondary school. Direct appropriations to higher education institutions are measured by the percentage of total appropriations that the state allocated to higher education in 1991–1992 and the percentage of higher education appropriations that the state allocated to public rather than private institutions in 1991–1992.

The analyses also include several measures of the average sticker price of different sectors of higher education in the state in the 1992–1993 academic year: average tuition at public two-year institutions; ratio of average tuition at public four-year institutions to average tuition at public two-year institutions; ratio of average tuition at private four-year institutions to the average tuition at public two-year institutions; and ratio of average tuition at private four-year institutions in the region to the average tuition at public two-year institutions in the state. We derived data for appropriations and tuition from *Digest of Education Statistics* (NCES, 1994).

State public policies regarding student financial aid are measured by the following variables: the amount of need-based financial aid in the state per traditional college-age (18 to 24 year old) population in 1992–1993; the

percentage of state financial aid that was allocated to non-need-based programs per traditional college-age population in 1992–1993; and whether the state provided funds for need-based financial aid to private colleges and universities in the state in 1992–1993. The source of data for these measures is the *NASSGAP 24th Annual Survey Report 1992–1993 Academic Year* (NASSGAP, 1993).

We measured state public policies regarding academic preparation during elementary and secondary school by the percentage of revenues that public elementary and secondary schools in 1992–1993 received from the state government; the percentage of current expenditures for public elementary and secondary education that was allocated to instruction in 1992–1993; the number of math units required for high school graduation in 1992; whether the state required students to pass a test in math to graduate from high school in 1992; the percentage of public school teachers in the state with a master's, education specialist, or doctoral degree in 1990–1991; the ratio of students to teachers in fall 1992; the ratio of students to guidance counselors in fall 1992; and average annual teacher salaries in public elementary and secondary schools in 1991–1992. We obtained data for these state-level indicators from *State Comparisons of Education Statistics: 1969–70 to 1996–97* (NCES, 1998).

The analyses also control for other state characteristics. Reflecting the indicators that are reported in *Measuring Up 2000* (National Center for Public Policy and Higher Education, 2000), we measured state economic and demographic characteristics by the percentage of children living in poverty, the percentage of adults who have attained at least a bachelor's degree, and the unemployment rate. Data for these indicators came from the *Current Population Survey* (U.S. Bureau of the Census, 1993, 1994). The analyses also control for the distribution of higher education institutions in the state by sector, by including the ratios of higher education institutions that are private for-profit, public two-year, and public four-year, relative to private four-year. We obtained data for these indicators from the *Digest of Education Statistics* (NCES, 1994).

Following the example of Jim Hearn and colleagues (1996), we included geographic region as a proxy for unmeasured differences in a region's tradition and philosophy toward both higher and K–12 education. We grouped the states into six geographic regions: Northeast (reference group), Midwest, Southeast, Southwest, Rockies/Plains, and Northwest.

We standardized all continuous student- and state-level variables with a mean of zero and standard deviation of one. Correlations among the indicators of state public policies and other state characteristics are low to moderate, ranging from -0.066 to 0.492 , suggesting that these variables measure distinct constructs.

ANALYSES

We used descriptive analyses, including cross tabulations and analysis of variance, to examine differences among students by SES in terms of the student- and state-level predictors in the model. Hierarchical linear modeling (HLM) is used to examine the relationship between state contextual characteristics and the dependent variable: type of institution initially attended.¹

HLM is appropriate because the research questions focus on the role of state contextual characteristics, variables that are measured at the macro level, on a student-level outcome (enrollment), while controlling for student-level characteristics, variables that are measured at the micro level (Bryk & Raudenbush, 1992). Failing to statistically account for different units of analysis (e.g., student and state) can lead to aggregation bias, miscalculation of standard errors, and heterogeneity of regression (Bryk & Raudenbush, 1992). HLM is also appropriate because the results of a single-level random multinomial model reveal substantial variability across the 50 states in the type of postsecondary institution that high school graduates attend. The analyses reveal that, after controlling for student-level characteristics, the likelihood of enrolling at any type of in-state institution except a public two-year institution varies across states.

Because the outcome variable is categorical, we used the multinomial extension of HLM (Raudenbush & Bryk, 2002). Since the dependent variable has five categories, we estimated four student-level models. The multinomial student-level structural model is expressed as:

$$\eta_{mij} = \beta_{0j(m)} + \beta_{1j(m)} * (\text{SOCIOECONOMIC STATUS})_{ij} + \beta_{2j(m)} * (\text{FEMALE})_{ij} \\ + \beta_{3j(m)} * (\text{RACE})_{ij} + \beta_{4j(m)} * (\text{TEST SCORES})_{ij} \\ + \beta_{5j(m)} * (\text{HIGHEST LEVEL MATH})_{ij} + \beta_{6j(m)} * (\text{PARENT DISCUSSIONS})_{ij} \\ + \beta_{7j(m)} * (\text{MISSING DATA})_{ij}, \quad (1)$$

where i denotes the student, j denotes the state, and m denotes 1 to 4 types of enrollment. The fifth category of enrollment, no enrollment, is the reference category.

The beta coefficients in equation (1) characterize the distribution of college enrollment in state j given observable student characteristics. Unlike other statistical methods, HLM assumes that these structural relations vary across states. However, because of the limited number of cases at the state level ($n = 50$), the multinomial extension of the HLM software does not permit an examination of variations across states in the beta coeffi-

¹A variety of models falls under the category of HLM including fixed effects, random coefficients, and random effects models.

cients for the independent variables in equation (1). Therefore, only the regression coefficients for the intercept are assumed to vary across states. The effects of all within-state predictors are constrained to be the same for all states (Bryk & Raudenbush, 1992). Specifically:

$$\begin{aligned}\beta_{0j(m)} &= \mathbf{r}_{00(m)} + \mathbf{r}_{01(m)} * (\text{STATE APPROPRIATIONS})_j + \mathbf{r}_{02(m)} * (\text{FINANCIAL AID})_j \\ &\quad + \mathbf{r}_{03(m)} * (\text{TUITION})_j + \mathbf{r}_{04(m)} * (\text{K-12 ACADEMIC PREPARATION})_j \\ &\quad + \mathbf{r}_{05(m)} * (\text{OTHER STATE CHARACTERISTICS})_j + \mathbf{r}_{06(m)} * (\text{REGION})_j \\ &\quad + U_{0j(m)} \\ \beta_{qj(m)} &= \mathbf{r}_{q0(m)}, \text{ where } q \text{ denotes 1 to 7 student-level predictors, } j \text{ denotes state,} \\ &\text{and STATE APPROPRIATIONS, FINANCIAL AID, TUITION, K-12 ACADEMIC PREPARATION, and OTHER STATE CHARACTERISTICS are vectors of variables.}\end{aligned}$$

Odds-ratios facilitate the interpretation of the multinomial logit coefficients. The odds-ratio represents the change in the odds of a particular type of enrollment relative to the reference category (not enrolled) that is associated with a one-unit change in a particular independent variable holding constant all other variables (Peng et al., 2002). An odds-ratio greater than one represents an increase in the likelihood of enrolling in a particular type of college or university relative to not enrolling, whereas an odds-ratio less than one represents a decrease in the likelihood of that type of enrollment.

All student-level variables are centered around their grand means. Grand-mean centering controls for differences in student characteristics between states. As a result, the intercept term in equation (1) may be interpreted as the adjusted college enrollment rate, or the estimated rate of enrolling in college for students having the average characteristics for the entire sample (Rumberger, 1995; Rumberger & Thomas, 2000).

Because the number of state-level characteristics that may be included in the analyses is restricted by the number of states ($n = 50$), state-level predictors are entered into the model in conceptually related blocks in order to identify the most salient state-level predictors of college enrollment. We retained in the final model only state-level predictors with coefficients that are statistically significant at the $p < .05$ level.

LIMITATIONS

In addition to the inability of the software to examine variations across states in the beta coefficients for the student-level variables, this research is subject to other limitations. One limitation is the inability to use sample weights at the student level to correct for sampling error, nonresponse, and the oversampling of some groups (Raudenbush et al., 2000). The NELS sample design included oversampling of Hispanic and Asian/Pacific Islander students in the base year and disproportionate retention of Hispanic, Asian/

Pacific Islander, and American Indian students in the 1990 follow-up (NCES, 1994).

Like all secondary data analyses, this research is limited by the availability of suitable proxies. The indicators of state higher education policies are clearly simplifications of underlying policies. A related limitation pertains to differences in the definition of particular policies across states. For example, states differ in terms of the criteria used to award "need-based" student financial aid, with some states (e.g., Colorado, Florida, Georgia, and Rhode Island) relying on the federal definition, other states using the federal criteria with some additional criteria (e.g., Arkansas, California, Michigan, and Washington), and still other states substituting their own definition for the federal definition (e.g., Delaware, Kentucky, Louisiana, and New York) (NASSGAP, 1993).

RESULTS

Relationship Between State Public Policies and the Type of Institution that Students Attend

The multilevel multinomial analyses show that measures of all four types of state public policies (direct appropriations, tuition, financial aid, and K–12 education) are related to the type of higher education institution in which high school graduates enroll. In terms of direct appropriations, the multilevel multinomial analyses show that the average likelihood of enrolling in an out-of-state higher education institution relative to not enrolling declines as the share of total state appropriations that is allocated to higher education institutions increases, regardless of whether SES is measured as a continuous variable (odds ratio = 0.75, Table 1) or categorical variable (odds ratio = 0.73, Table 2). Although several measures of tuition were included in the analyses, only the coefficient for the ratio of average tuition at private four-year institutions to average tuition at public two-year institutions was statistically significant. Tables 1 and 2 show that, as the gap between average tuition at private four-year institutions and average tuition at public two-year institutions in the state widens, the average likelihood of enrolling in an in-state public four-year college or university relative to not enrolling increases (odds ratio = 1.18, Table 1 and odds ratio = 1.17, Table 2).

The level of state support for need-based financial aid is also related to the type of institution in which high school graduates enroll. The average likelihood of enrolling in an in-state private four-year college or university, relative to not enrolling, increases with the amount of state need-based financial aid relative to the college-age population in the state, regardless of whether SES is measured as a continuous variable (odds ratio = 1.62, Table 1) or categorical variable (odds ratio = 1.60, Table 2). Greater amounts of state need-based aid per traditional college-age population also appear to

TABLE 1

ODDS-RATIOS FOR ENROLLING IN DIFFERENT TYPES OF COLLEGES OR UNIVERSITIES IN FALL 1992 THAT ARE ASSOCIATED WITH A ONE-UNIT CHANGE IN EACH PREDICTOR AMONG 1992 HIGH SCHOOL GRADUATES (CONTINUOUS SES)

	<i>In-state public 2-year</i>		<i>In-state public 4-year</i>		<i>In-state private 4-year</i>		<i>Out-of-state public or private 2 year or 4-year</i>	
Predictors								
Student-level¹								
Socioeconomic status	1.471	***	1.991	***	2.049	***	3.529	***
Female	1.291	***	1.277	***	1.595	***	1.207	**
<i>Male (reference category)</i>								
African American	1.048		2.636	***	3.047	***	3.895	***
Asian	1.274		2.548	***	2.468	***	1.763	**
Hispanic	1.095		2.199	***	1.467	*	1.802	***
<i>White (reference category)</i>								
Test scores	1.194	***	2.098	***	2.219	***	2.453	***
Took algebra I & geometry	1.666	***	1.721	***	1.590	**	1.190	
Took algebra II	2.277	***	5.681	***	4.421	***	3.371	***
Took advanced math	2.432	***	12.565	***	10.783	***	8.549	***
<i>Took less or no math (reference)</i>								
Parental discussions with student	1.369	***	1.552	***	1.835	***	1.724	***
Number student-level variables missing	0.846	**	1.025		1.017	1.113		
State-level²								
State appropriations to higher education	1.047		1.046		1.109		0.746	**
Tuition: 4-year private vs. 2-yr public	1.174		1.181	**	1.152		0.990	
State need-based financial aid	1.188		1.162	*	1.621	***	1.157	
Student-teacher ratio at K–12 level	0.972		0.831	*	0.786		0.787	*
2-year public/4-year private institutions	1.650	***	0.897		0.864		0.932	
4-year public/4-year private institutions	0.602	***	1.336	**	0.979		1.124	
Midwest <i>(relative to Northeast)</i>	0.757		1.615	**	1.122		0.813	
Southeast <i>(relative to Northeast)</i>	0.966		1.635	**	1.576		0.692	
Random effect³								
Intercept	0.208	***	0.079	***	0.252	***	0.246	***
Reliability of intercept	0.674		0.489		0.550		0.644	

Notes: Odds-ratios are relative to not enrolling. All continuous variables at the student- and state-levels are standardized with a mean of 0 and standard deviation of 1. Only unit-specific estimates are generated in the multinomial HLM analyses. Unit-specific estimates describe the effect of a change in a given state-level predictor on the odds of enrolling in a higher education institution in a particular state (Raudenbush & Bryk, 2002).

¹The odds-ratios for the student-level variables are the beta parameters in equation (1).

²The odds-ratios for the state-level variables are the gamma parameters in equation (2) that determine β_{0j} .

³The random effects are the $u_{0j(m)}$ terms in equation (2).

Source: Analyses of NELS:92/94; NASSGAP 1992–1993; NCES data, various years.

*** $p < .001$

** $p < .01$

* $p < .05$

be associated with an increased likelihood of enrolling in an in-state public four-year institution relative to not enrolling although the positive effect is smaller in magnitude than that associated with enrolling in an in-state private four-year institution (odds ratio = 1.16, Table 1 and odds ratio = 1.15, Table 2).

The analyses show that one measure of a K–12 state public policy that may reflect the level of academic preparation is related to college enrollment patterns: the ratio of students to teachers in the state's elementary and secondary schools. An increase in the ratio is associated with a decline in the average probability of enrolling at either an in-state public four-year institution (odds ratio = 0.83, Table 1 and odds ratio = 0.84, Table 2) or an out-of-state institution (odds ratio = 0.79, Tables 1 and 2) relative to not enrolling net of other variables.

The composition of the higher education system in the state also appears to be related to the enrollment patterns of high school graduates. Tables 1 and 2 show that the likelihood of enrolling in a public two-year institution relative to not enrolling increases with the ratio of two-year public institutions to private four-year institutions in the state (odds ratio = 1.65, Table 1 and odds ratio = 1.66, Table 2). As the ratio of four-year public institutions to private four-year institutions in the state increases, the likelihood of enrolling in a public two-year institution decreases (odds ratio = 0.60, Tables 1 and 2) and the likelihood of enrolling in a public four-year institution increases (odds ratio = 1.34, Table 1 and odds ratio = 1.36, Table 2).

Even after controlling for the student- and state-level variables in the model, the region in which a high school graduate resides is related to college enrollment patterns. Tables 1 and 2 show that, net of other variables, high school graduates in the Midwest and Southeast are more likely to choose in-state public four-year colleges and universities rather than not enroll than high school graduates in the Northeast. Coefficients for such measures of state economic and demographic characteristics as the share of the popula-

TABLE 2

ODDS-RATIOS FOR ENROLLING IN DIFFERENT TYPES OF COLLEGES OR UNIVERSITIES IN FALL 1992 THAT ARE ASSOCIATED WITH A ONE-UNIT CHANGE IN EACH PREDICTOR AMONG 1992 HIGH SCHOOL GRADUATES (LOWEST SES AND HIGHEST SES)

	<i>In-state public 2-year</i>	<i>In-state public 4-year</i>	<i>In-state private 4-year</i>	<i>Out-of-state public or private 2 year or 4-year</i>
Predictors				
Student-level¹				
Lowest socioeconomic status	0.590 ***	0.439 ***	0.588 ***	0.411 ***
Highest socioeconomic status	1.436 **	2.554 ***	3.156 ***	5.940 ***
Female	1.276 ***	1.251 **	1.548 ***	1.143
<i>Male (reference category)</i>				
African American	0.997	2.450 ***	2.278 ***	3.481 ***
Asian	1.240	2.431 ***	2.785 ***	1.705 **
Hispanic	1.023	1.961 **	1.254	1.458 *
<i>White (reference category)</i>				
Test scores	1.215 ***	2.137 ***	2.265 ***	2.610 ***
Took algebra I & geometry	1.677 ***	1.760 ***	1.676 **	1.243
Took algebra II	2.285 ***	5.716 ***	4.520 ***	3.435 ***
Took advanced math	2.452 ***	12.636 ***	10.948 ***	8.845 ***
<i>Took less or no math (reference)</i>				
Parental discussions with student	1.386 ***	1.572 ***	1.862 ***	1.793 ***
Number student-level variables missing	0.847 **	1.029	1.028	1.139
State-level²				
State appropriations to higher education	1.037	1.033	1.095	0.728 **
Tuition: 4-year private vs. 2-yr public	1.167	1.173 **	1.145	0.984
State need-based financial aid	1.182	1.147 *	1.597 ***	1.129
Student-teacher ratio at K-12 level	0.980	0.837 *	0.791	0.788 *
2-year public/4-year private institutions	1.662 ***	0.906	0.877	0.948
4-year public/4-year private institutions	0.600 ***	1.364 **	0.971	1.109
Midwest <i>(relative to Northeast)</i>	0.750	1.588 **	1.104	0.786
Southeast <i>(relative to Northeast)</i>	0.945	1.563 **	1.478	0.644
Random effect³				
Intercept	0.215 ***	0.073 ***	0.242 ***	0.249 ***
Reliability of intercept	0.680	0.475	0.543	0.649

Notes: Odds-ratios are relative to not enrolling. The lowest SES and highest SES groups are compared to the average combined effect of the 2nd and 3rd SES quartiles. All continuous variables at the student- and state-levels are standardized with a mean of 0 and standard deviation of 1.

¹The odds-ratios for the student-level variables are the beta parameters in equation (1).

²The odds-ratios for the state-level variables are the gamma parameters in equation (2) that determine β_{0j} .

³The random effects are the $u_{0j(m)}$ terms in equation (2).

Source: Analyses of NELS:92/94; NASSGAP 1992-1993; NCES data, various years.

*** $p < .001$

** $p < .01$

* $p < .05$

tion with a bachelor's degree and the state unemployment rate are not statistically significant net of other variables in the model.

Enrollment Patterns by Socioeconomic Status

The pattern of college enrollment among 1992 high school graduates varies by SES. Table 3 shows that about one half (49%) of high school graduates in the lowest quartile of SES, but only 7% of high school graduates in the highest quartile of SES, did not enroll in any type of college or university in the fall after high school graduation. Only 16% of high school graduates with the highest SES, but 25% of all high school graduates, enrolled in an in-state public two-year college. Smaller shares of low-SES high school graduates than of high-SES high school graduates enrolled in in-state, public four-year institutions (15% versus 35%), in-state, private four-year institutions (5% versus 12%), and out-of-state institutions (5% versus 31%).

The multilevel multinomial analyses show that, even after controlling for student-level and state-level predictors, high school graduates in the lowest quartile of SES are less likely to enroll in any type of college or university than they are not to enroll. (See Table 2.) Conversely, high school graduates in the highest SES quartile are more likely to enroll in all types of colleges or universities, including public two-year institutions.

To separate the relationship between SES and enrollment in a particular type of college or university (i.e., choice) from the relationship between SES and enrollment in any type of college or university (i.e., access), Table 4 shows the relative odds-ratios that are associated with different types of enrollment by SES. Compared with high school graduates with SES in the middle two quartiles, high school graduates in the highest quartile of SES are 1.78 times more likely to enroll in an in-state public four-year institution, 2.20 times more likely to enroll in an in-state private four-year institution, and 4.14 times more likely to enroll in an out-of-state institution rather than an in-state public two-year institution after other variables are taken into account. In contrast, high school graduates in the lowest quartile of SES are less likely to enroll in an in-state public four-year institution (odds ratio = 0.75) or an out-of-state institution (odds ratio = 0.70) than enroll

TABLE 3
DISTRIBUTION OF 1992 HIGH SCHOOL GRADUATES BY
SOCIOECONOMIC STATUS QUARTILE AND COLLEGE
ENROLLMENT STATUS IN FALL 1992

<i>Type of institution enrolled in</i>	<i>Socioeconomic Status Quartile</i>					<i>Statistical Difference</i>
	<i>Total</i>	<i>Lowest</i>	<i>Second</i>	<i>Third</i>	<i>Highest</i>	
Total	100.0%	100.0%	100.0%	100.0%	100.0%	$\phi = 0.45$
In-state public two-year	24.7	26.3	29.4	27.5	15.7	
In-state public four-year	26.6	14.8	24.8	30.2	34.6	
In-state private four-year	8.1	5.2	6.2	8.9	11.8	
Out-of-state	14.8	4.7	7.9	14.1	31.2	
Not enrolled	25.8	49.0	31.7	19.3	6.7	

Notes: Data are weighted by the normalized 1992–94 panel weight (F3F1PNWT).

The statistical difference column shows the strength of the relationship, calculated using the following formula: $\phi = (\chi^2/n)$. A ϕ that is below 0.3 represents a “small” effect size; a ϕ that is greater than 0.5 is “large.”

Source: Analyses of NELS:92/94.

in an in-state public two-year institution after taking into account student- and state-level variables and are about as likely to enroll in an in-state private four-year institution as an in-state public two-year institution net of other variables. Both low-SES and high-SES high school graduates are more likely to enroll in an in-state private four-year institution than in an in-state public four-year institution. However, low-SES high school graduates are less likely, and high-SES high school graduates are more likely, to enroll in an out-of state institution than either an in-state public four-year institution or an in-state private four-year institution.

DISCUSSION

At least six conclusions may be drawn from this research. First, the results of this study confirm the conclusion by the Institute for Higher Education Policy (1999, 2002) that higher education enrollment patterns are stratified by SES. Even after controlling for student-level predictors of college choice and state contextual variables, low-SES high school graduates are less likely than other high school graduates to enroll in any type of college or university in the fall after graduating from high school. Among those who enroll, those with low SES are more likely, and those with high-SES are less likely, than those with middle-SES to enroll in an in-state public two-

TABLE 4
RELATIVE ODDS-RATIOS FOR ENROLLING IN DIFFERENT TYPES OF COLLEGES AND UNIVERSITIES THAT ARE ASSOCIATED WITH A ONE-UNIT CHANGE IN SES AMONG 1992 HIGH SCHOOL GRADUATES, CONTROLLING FOR STUDENT-LEVEL AND STATE-LEVEL VARIABLES (SEE TABLES 1 AND 2)

<i>Socioeconomic Status Variable</i>	<i>In-state public 4-year</i>	<i>In-state private 4-year</i>	<i>Out-of-state public or private 2 year or 4-year</i>
Versus in-state public 2-year			
SES (continuous)	1.353 ***	1.393 ***	2.399 ***
Low SES	0.745 ***	0.996 ***	0.697 ***
High SES	1.779 ***	2.198 ***	4.138 ***
Versus in-state public 4-year			
SES (continuous)		1.029 ***	1.773 ***
Low SES		1.338 ***	0.935 ***
High SES		1.236 ***	2.326 ***
Versus in-state private 4-year			
SES (continuous)			1.723 ***
Low SES			0.699 ***
High SES			1.883 ***

Notes: The lowest SES and highest SES groups are compared to the average combined effect of the 2nd and 3rd SES quartiles.

Source: Analyses of NELS:92/94; NASSGAP 1992-1993, NLES data, various years.

*** p < .001

** p < .01

* p < .05

year institution than an in-state public four-year institution or an out-of-state institution. These findings have important implications for the long-term educational, economic, and social status attainment of high school graduates from low-SES families. Individuals who enroll in a four-year college immediately after graduating from high school are substantially more likely than other students to earn a bachelor's degree (Cabrera, La Nasa, & Burkam, 2001) and, consequently, are more likely to realize the associated long-term benefits (Leslie & Brinkman, 1988; Pascarella & Terenzini, 1991). Individuals who complete at least a bachelor's degree realize not only higher earnings but also enhanced occupational status and lower likelihood of unemployment (Leslie & Brinkman, 1988).

Second, although state public policies do not explain SES differences in college enrollment, measures of all four types of state public policies (direct appropriations to higher education institutions, tuition, financial aid to students, and elementary and secondary education) are related to the enrollment patterns of high school graduates. Although only one measure of a K–12 educational policy was related to the type of college attended (student-teacher ratio), academic preparation, as measured by mathematics coursework, was the strongest student-level predictor of college enrollment. Thus, the results of this study support the merits of a K–16 approach that explicitly recognizes the linkages between K–12 and higher education. States should consider adopting an integrated approach to educational policy that acknowledges the ways in which K–12 education policies influence student academic preparation for college and the ways in which higher education policies influence a student's ability to pay the costs of attending different types of institutions.

Third, this research demonstrates the importance of viewing the effects of state public policies on a state's higher education system as a whole. The analyses show that appropriations, tuition, aid, and K–12 education influence the distribution of college enrollments within a state. For example, a larger gap in the average tuition at private and public institutions is associated with an increased likelihood of enrolling in a public four-year institution. This finding suggests that keeping public sector tuition low may promote access to public four-year institutions in the state. This finding also suggests, as some (e.g., Herzlinger & Jones, 1993) observe, that a larger private-public tuition gap reduces the competitiveness of private four-year institutions, with potentially negative implications for the financial well-being of private four-year institutions as well as the size and diversity of the state's private higher education sector.

Fourth, the analyses suggest that state need-based financial aid and institutional financial aid promote student choice among different types of colleges and universities. State need-based financial aid programs with relatively large awards per member of the traditional college-age population appear to be particularly effective at promoting enrollment in private four-year colleges and universities in a state. This finding is consistent with descriptive analyses showing that a higher share of undergraduates at private four-year institutions (22%) than of undergraduates at other types of institutions including public four-year institutions (14%) receive state financial aid (Lee & Clery, 1999). The positive relationship between state financial aid and enrollment in a private four-year institution may compensate for the negative relationship between the public-private tuition gap and this type of enrollment.

Institutional financial aid may also be promoting student choice among institutions as the analyses show that high school graduates in the lowest

quartile of SES are more likely to enroll in an in-state private four-year institution than an in-state public four-year institution after controlling for other student- and state-level variables. This finding suggests that private four-year colleges and universities are more effective than public four-year colleges and universities at targeting need-based institutional and campus-based federal financial aid resources (variables that were not examined in this study) to low-SES students in the state. Future analyses, such as a multilevel analysis in which institutions are embedded within states, should further explore these relationships.

Fifth, the analyses suggest that increasing direct appropriations to higher education institutions in the state may help reduce “brain drain.” The analyses show that, even after controlling for other student- and state-level predictors, the likelihood of enrolling in an out-of-state higher education institution declines as the share of total appropriations to higher education institutions in the state increases. The analyses also show that the odds of enrolling in an out-of-state institution are substantially higher for students with the highest SES than for other students. Because SES is positively correlated with academic achievement, these results suggest that out-migration of the “best and brightest” high school graduates to colleges and universities in other states is lower in states that allocate a relatively higher percentage of appropriations to higher education. However, future research should explore the extent to which the relationship between state appropriations and out-of-state migration is changing, given that the share of higher education revenues funded by state governments has been declining. Although the total dollar amount of state appropriations per student has been increasing (National Center for Public Policy and Higher Education, 2002), the share of current-fund revenues from state governments declined from 29% in 1980–1981 to 20% in 1995–1996 (NCES, 2001). Some researchers (e.g., Breneman & Finney, 1997; Heller, 2002; Hovey, 2001) argue that the decline in the share of higher education revenues from state sources reflects a “new era” of reduced state support, an era characterized by growing competition for state financial support and increasing pressure on state officials to reduce spending on the small number of discretionary items in the state budget (such as higher education), growing distrust by the public and policymakers about higher education, and rising belief that alternative (i.e., nonstate) sources of revenues for higher education are available. Future research should also examine the effects on out-migration in general and brain drain in particular of state-sponsored merit aid programs, programs that were in their infancy in 1992 when the high school graduates in this study were enrolling in college.

Finally, the analyses show that college enrollment patterns mirror the composition of a state’s higher education system. This finding suggests that the composition of a state’s higher education system shapes a student’s habi-

tus for enrollment in different types of higher education institutions. Specifically, more information may be available to students about the types of institutions that are relatively more prevalent in the state, and students tend to enroll in the types of institutions about which they know the most.

States should consider these implications in the context of their goals and values. Specifically, the interpretation of the implications that are generated by this research depends on a state's value judgments regarding the most appropriate definition of college "choice," a state's vision of the ideal composition of the state higher education system, and the extent to which a state believes it should remove barriers to college enrollment for low-SES students. The definition of choice may range from the ability to attend at least one four-year college or university to the ability to attend the four-year college or university that is most suitable for a particular student, given that student's interests and abilities (Institute, 2002).

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